Chapter A2: Need for the Regulation

INTRODUCTION

Many CWIS have been constructed on sensitive aquatic systems with capacities and designs that cause damage to the waterbodies from which they withdraw water. In addition, the absence of regulations that establish national standards for BTA has led to an inconsistent application of section 316(b). In fact, only 150 out of 554 Phase II facilities have indicated on EPA's 2000 Section 316(b) Industry Survey that they have ever performed an impingement and entrainment (I&E) study (U.S. EPA, 2000).

This chapter provides a brief overview of the facilities subject to this rule and their use of cooling water, and presents the need for this regulation.

CHAPTER CONTENTS

A2-1 OVERVIEW OF REGULATED FACILITIES

The Final Section 316(b) Phase II Existing Facilities Rule applies to existing power producing facilities with a design intake flow of 50 MGD or greater. The Phase II rule also covers substantial additions or modifications to operations undertaken at such facilities. The final Phase II rule does not cover (1) new steam electric power generating facilities, (2) new facilities in other industry sectors, (3) existing steam electric power generating facilities with a design intake flow of less than 50 MGD, and (4) existing facilities in other industry sectors.[1]

The remainder of this section describes the industry sectors subject to the Phase II rule and the existing utility and nonutility steam electric power generating facilities analyzed for this regulatory effort. *Chapter A3: Profile of the Electric Power Industry* and *Chapter B3: Electricity Market Model Analysis* of this Economic and Benefits Analysis (EBA) present more detailed information on the facilities subject to the Phase II rule and the market in which they operate.

A2-1.1 Phase II Sector Information

Past section 316(b) regulatory efforts and EPA's effluent guidelines program identified steam electric generators as the largest industrial users of cooling water. The condensers that support the steam turbines in these facilities require substantial amounts of cooling water. EPA estimates that steam electric utility power producers (SIC Codes 4911 and 4931) and steam electric nonutility power producers (SIC Major Group 49) account for approximately 92.5 percent of total cooling water intake in the United States (U.S. EPA, 2001). Beyond steam electric generators, other industrial facilities use cooling water in their production processes (e.g., to cool equipment, for heat quenching, etc.).

EPA's 2000 Section 316(b) Industry Survey collected cooling water information for 676 power producers and 396 other industrial facilities. These facilities withdraw 216 and 26.5 billion gallons per day (BGD) of cooling water, respectively. Of the power producers, 543 meet the "in-scope" requirements of this final rule. These 543 facilities represent 554 facilities in

[1] New facilities were covered under the Final Section 316(b) New Facility Rule (Phase I), which EPA promulgated in November 2001. Existing steam electric power generating facilities with a design intake flow of less than 50 MGD and facilities in other industry sectors will be addressed by a separate rule (Phase III).

the industry.[2] Based on the survey, the 554 Phase II facilities account for approximately 216 BGD, or 98 percent of the estimated average flow of all power producers. Industrial categories other than power producers are not covered by this final Phase II rule.

Table A2-1 summarizes cooling water use information of steam electric power generating facilities and major industrial categories.

Table A2-1: Estimated Cooling Water Intake by Sector - EPA Survey

Sector[a]	Estimated Number of Facilities	Total Cooling Water Intake Average Flow	Cooling Water Intake Average Flow Subject to Phase II Rule	
		Billion Gal./Yr.	Billion Gal./Yr.	Percent of Total Steam Electric and Industrial
Steam Electric Power Producers	708	81,753	78,703	82.4%
Steam Electric Utility Power Producers	*591*	*72,665*	*71,471*	*74.8%*
Steam Electric Nonutility Power Producers	*117*	*9,088*	*7,232*	*7.6%*
Major Industrial Categories[b]	773	13,752	0	0.0%
Total Steam Electric and Industrial	**1,481**	**95,505**	**78,703**	**82.4%**

[a] Estimates for each sector are based on facility categorization at the time of the survey; some utility facilities have since been sold to non-utilities.

[b] Major industrial categories (major SIC codes) surveyed with EPA questionnaires: Paper and Allied Products (SIC Major Group 26), (2) Chemicals and Allied Products (SIC Major Group 28), (3) Petroleum and Coal Products (SIC Major Group 29), and (4) Primary Metals Industries (SIC Major Group 33).

Source: U.S. EPA, 2000.

A2-1.2 Phase II Facility Information

The 554 steam electric power generating facilities subject to the final Phase II rule comprise a substantial portion of the U.S. electric power market. As shown in Table A2-2, the 554 facilities represent 14 percent of all facilities in the U.S. electric power market. In 2008, the Phase II facilities are projected to have a generating capacity of 438,000 megawatt (MW; 50 percent of total), generate 2.4 billion megawatt hours of electricity (MWh; 59 percent of total), and realize $80 billion in revenues (52 percent of total).

[2] EPA applied sample weights to the 543 facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table A2-2: Summary Economic Data for Electricity Market and Phase II Facilities			
Economic Measure	Industry Total[a]	Facilities Subject to Phase II Rule[b]	
		Phase II Total	% of Industry Total
Number of Facilities	4,091	554	14%
Electric Generating Capacity (MW)	873,000	438,000	50%
Net Generation (million MWh)	4,060	2,400	59%
Revenues (in billions, $2001)	$154	$80	52%

[a] Industry Totals are based on ICF Consulting's Integrated Planning Model (IPM®), section 316(b) base case, 2008. The IPM models 4,091 unique facilities. Industrial boilers are not modeled by the IPM. For a discussion of EPA's use of the IPM in support of this final rule, see *Chapter B3: Electricity Market Model Analysis*.

[b] The IPM models 535 of the 543 Phase II facilities. Seven of the 535 facilities are closures in the section 316(b) base case run for 2008. The Phase II totals for capacity, generation, and revenues include the activities of the 528 in-scope facilities that are modeled by the IPM and are not closures in the base case.

Source: IPM analysis: model run for Section 316(b) base case, 2008 (EPA electricity demand growth assumptions).

Most of the analyses of economic impacts and energy effects presented in this Economic and Benefits Analysis present results by geographic region (i.e., North American Electric Reliability Council, or "NERC," region). Analyzing results by geographic region is of interest because regional concentrations of compliance costs could adversely impact electric power system reliability and prices, if a large percentage of overall capacity is affected. Some analyses are also presented by plant type. Analyzing results by plant type is of interest because a regulation that has disproportionate effects on particular types of facilities could lead to shifts in technology selection, if the effects are substantial enough.

Table A2-3 presents the distribution of facilities subject to the Phase II rule by NERC region and plant type. The table shows that the majority of facilities subject to the Phase II rule, 302, or 54.5 percent, are coal-fired steam-electric facilities. The other major plant types are oil- or gas-fired steam-electric facilities (168, or 30.3 percent) and nuclear facilities (59, or 10.7 percent). The remaining 4.5 percent are combined-cycle or other steam facilities. On a regional level, the East Central Area Reliability Council (ECAR) and the Southeastern Electric Reliability Council (SERC) account for the highest numbers of Phase II facilities with 102 (18.4 percent) and 96 (17.3 percent), respectively.

Table A2-3: Distribution of Phase II Facilities by NERC Region and Plant Type

NERC Region[a]	Coal	Combined Cycle	Nuclear	Oil/Gas	Other Steam	Total	Percent of Phase II
ASCC	1	0	0	0	0	**1**	**0.2%**
ECAR	92	1	6	3	0	**102**	**18.4%**
ERCOT	9	1	2	39	0	**51**	**9.2%**
FRCC	7	5	1	17	0	**30**	**5.4%**
HI	0	0	0	3	0	**3**	**0.5%**
MAAC	17	2	8	15	2	**45**	**8.1%**
MAIN	42	0	9	2	0	**53**	**9.6%**
MAPP	34	0	4	6	0	**44**	**7.9%**
NPCC	17	4	9	27	5	**61**	**11.0%**
SERC	56	1	17	22	0	**96**	**17.3%**
SPP	19	0	1	12	0	**32**	**5.8%**
WSCC	7	3	2	21	1	**35**	**6.3%**
Total	**302**	**17**	**59**	**168**	**8**	**554**	
Percent of Phase II	**54.5%**	**3.1%**	**10.7%**	**30.3%**	**1.4%**		

[a] **Key to NERC regions:** ASCC – Alaska Systems Coordinating Council; ECAR – East Central Area Reliability Coordination Agreement; ERCOT – Electric Reliability Council of Texas; FRCC – Florida Reliability Coordinating Council; HI – Hawaii; MAAC – Mid-Atlantic Area Council; MAIN – Mid-America Interconnect Network; MAPP – Mid-Continent Area Power Pool; NPCC – Northeast Power Coordinating Council; SERC – Southeastern Electric Reliability Council; SPP – Southwest Power Pool; WSCC – Western Systems Coordinating Council.

Source: U.S. DOE, 2001.

A2-2 The Need for Section 316(b) Regulation

The withdrawal of cooling water removes trillions of aquatic organisms from waters of the U.S. each year, including plankton (small aquatic animals, including fish eggs and larvae), fish, crustaceans, shellfish, sea turtles, marine mammals, and many other forms of aquatic life. Most impacts are to early life stages of fish and shellfish.

Aquatic organisms drawn into CWIS are either impinged on components of the intake structure or entrained in the cooling water system itself. Impingement takes place when organisms are trapped on the outer part of an intake structure or against a screening device during periods of intake water withdrawal. Impingement is caused primarily by hydraulic forces in the intake stream. Impingement can result in (1) starvation and exhaustion; (2) asphyxiation when the fish are forced against a screen by velocity forces that prevent proper gill movement or when organisms are removed from the water for prolonged periods; (3) descaling and abrasion by screen wash spray and other forms of physical damage.

Entrainment occurs when organisms are drawn into the intake water flow entering and passing through a CWIS and into a cooling water system. Organisms that become entrained are those organisms that are small enough to pass through the intake screens, primarily eggs and larval stages of fish and shellfish. As entrained organisms pass through a plant's cooling water system, they are subject to mechanical, thermal, and/or toxic stress. Sources of such stress include physical impacts in the pumps and condenser tubing, pressure changes caused by diversion of the cooling water into the plant or by the hydraulic effects of the condensers, sheer stress, thermal shock in the condenser and discharge tunnel, and chemical toxemia induced by antifouling agents such as chlorine.

Rates of I&E depend on species characteristics, the environmental setting in which a facility is located, and the location, design, and capacity of the facility's CWIS. Species that spawn in nearshore areas, have planktonic eggs and larvae, and are small as adults experience the greatest impacts, since both new recruits and reproducing adults are affected (e.g., bay anchovy in estuaries and oceans). In general, higher I&E is observed in estuaries and near coastal waters because of the presence of spawning and nursery areas. By contrast the young of freshwater species are generally epibenthic and/or hatch from attached egg masses rather than existing as free-floating individuals, and therefore freshwater species may be less susceptible to entrainment.

The likelihood of I&E also depends on facility characteristics. If the quantity of water withdrawn is large relative to the flow of the source waterbody, a larger number of organisms will be affected. Intakes located in nearshore areas tend to have greater ecological impacts than intakes located offshore, since nearshore areas are usually more biologically productive and have higher concentrations of aquatic organisms (see Saila et al., 1997). EPA estimates that CWIS used by the 554 facilities subject to the final rule impinge and entrain millions of age 1 equivalent fish annually (see Table C2-1 in *Chapter C2: Summary of Current Losses Due to I&E* of this EBA for further detail).

In addition to direct losses of aquatic organisms from I&E, there are a number of indirect, ecosystem-level effects that may occur, including (1) disruption of aquatic food webs resulting from the loss of impinged and entrained organisms that provide food for other species, (2) disruption of nutrient cycling and other biochemical processes, (3) alteration of species composition and overall levels of biodiversity, and (4) degradation of the overall aquatic environment. In addition to the impacts of a single CWIS on currents and other local habitat features, environmental degradation can result from the cumulative impact of multiple intake structures operating in the same watershed or intakes located within an area where intake effects interact with other environmental stressors.

Several factors drive the need for this final section 316(b) rule. Each of these factors is discussed in the following sections.

A2-2.1 Low Levels of Protection at Phase II Facilities

Facilities in the power producing industry use a wide variety of cooling water intake technologies to maximize cooling system efficiency, minimize damage to their operating systems, and to reduce environmental impacts. The following subsections present data on technologies that have been identified as effective in protecting aquatic organisms from I&E. EPA used information from its 2000 Section 316(b) Industry Survey to characterize the 554 in-scope Phase II facilities with respect to these technologies.

a. Cooling water system (CWS) configuration and CWIS technologies

Closed-cycle cooling systems (e.g., systems employing cooling towers) are the most effective means of protecting organisms from I&E. Cooling towers reduce the number of organisms that come into contact with a CWIS because of the significant reduction in the volume of intake water needed by a closed-cycle facilities. Reduced water intake results in a significant reduction in damaged and killed organisms. Of the 554 in-scope Phase II facilities, 75 (14 percent) reported the use of closed-cycle cooling systems.

Discussions with NPDES permitting authorities and utility officials identified fine mesh screens as an effective technology for minimizing entrainment. They can, however, increase impingement. Data from the questionnaires indicate that of the 554 in-scope Phase II facilities, seven (one percent) employed fine mesh screens on at least one CWIS. These seven plants represented less than one percent of the cooling water withdrawn from surface waters by plants reporting data.

Table A2-4: Estimated Number of Facilities by CWS Configuration and CWIS Technology (Design Flow >= 50 MGD)										
CWIS Technology	CWS Configuration									
	Once Through		Recirculating		Combination		None/unknown		Total	
	#	%	#	%	#	%	#	%	#	%
Intake screening technologies	26	6.2%	0	0.0%	4	8.0%	0	0.0%	30	5.4%
Passive intake systems	44	10.5%	11	14.7%	9	18.0%	1	11.1%	65	11.7%
Fish diversion or avoidance systems	17	4.0%	2	2.7%	2	4.0%	0	0.0%	21	3.8%
Fish handling or return technologies	64	15.2%	5	6.7%	7	14.0%	2	22.2%	78	14.1%
Other/none/unknown	219	52.1%	50	66.7%	23	46.0%	5	55.6%	297	53.6%
Combination of technologies	50	11.9%	7	9.3%	5	10.0%	1	11.1%	63	11.4%
Total	**420**	**100.0%**	**75**	**100.0%**	**50**	**100.0%**	**9**	**100.0%**	**554**	**100.0%**

Source: U.S. EPA, 2000; U.S. EPA analysis, 2004.

b. Cooling system location

Another effective approach for minimizing AEI associated with CWIS is to locate the intake structures in areas with low abundance of aquatic life and design the structures so that they do not provide attractive habitat for aquatic communities. However, this approach is of little utility for existing facilities where options for relocating intake structures are infeasible. Table A2-5 shows the estimated number of facilities by the source of water from which cooling water is withdrawn. The table indicates that 135 steam electric power generation facilities are located on estuaries, tidal rivers, or oceans that are considered to be areas of high productivity and abundance. In addition, estuaries are often nursery areas for many species. The intake flow of these facilities totaled 32 percent of the total cooling water being withdrawn by all in-scope Phase II facilities. The remaining 419 facilities (68 percent of flow) were reported as being located on fresh waterbodies (including Great Lakes).

Table A2-5: Estimated Number of Facilities and Share of Intake Flow by Source of Waterbody Type (Design Flow >= 50 MGD)			
Waterbody Type	Number of Facilities	Percent of Total	Percent of Average Annual Intake Flow
Estuary/Tidal River	113	20%	25%
Ocean	22	4%	6%
Great Lake	57	10%	10%
Freshwater Stream/River	247	45%	32%
Lake/Reservoir	114	21%	27%
Total[a]	**554**	**100%**	**100%**

[a] Individual numbers may not add up to totals due to independent rounding.

Source: U.S. EPA, 2000.

A2-2.2 Reducing Adverse Environmental Impacts

There are multiple types of adverse environmental impacts associated with CWIS, including impingement and entrainment; reductions of threatened, endangered, or other protected species; damage to ecologically critical aquatic organisms, including important elements of the food chain; diminishment of a population's potential compensatory reserve; losses to populations, including reductions of indigenous species populations, commercial fishery stocks, and recreational fisheries; and stresses to overall communities or ecosystems as evidenced by reductions in diversity or other changes in system structure or function.

Impingement occurs when fish are trapped against intake screens by the velocity of the intake flow. Organisms may die or be injured as a result of:

- starvation and exhaustion,
- asphyxiation when velocity forces prevent proper gill movement,
- abrasion by screen wash spray,
- asphyxiation due to removal from water for prolonged periods, and
- removal from the system by means other than returning them to their natural environment.

Small organisms are entrained when they pass through a plant's condenser cooling system. Injury and death can result from the following:

- physical impacts from pump and condenser tubing,
- pressure changes caused by diversion of cooling water,
- thermal shock experienced in condenser and discharge tunnels, and
- chemical toxemia induced by the addition of anti-fouling agents such as chlorine.

Impingement and entrainment losses can be substantial. For example, it is estimated that annual entrainment at three Hudson River power plants results in year-class reductions of up to 20 percent for striped bass, 25 percent for bay anchovy, and 43 percent for Atlantic tomcod, even without assuming 100 percent mortality of entrained organisms (ConEd, 2000). At the San Onofre Nuclear Generating Station (SONGS), it was estimated that in a normal (non-El Nino) year 57 tons of fish were killed per year when all units were in operation (Murdoch, et al., 1989).[3] This included approximately 350,000 juvenile white croaker, a popular sport fish. This number represents 33,000 adult individuals or 3.5 tons of adult fish. It was found that losses at SONGS resulted in a 50 to 70 percent decline in local midwater fish within three kilometers of the plant.

The main purpose of this regulation is to minimize losses such as those described above. See *Part C: National Benefits* and *Part D: Benefit-Cost Analysis* of this EBA for information on estimated reduction in impingement and entrainment as a result of the final Phase II rule. See also the *Regional Studies for the Final Section 316(b) Phase II Existing Facilities Rule* (U.S. EPA, 2004) for detailed information on baseline losses.

A2-2.3 Addressing Market Imperfections

Facilities withdraw cooling water from a water of the U.S. to support electricity generation, steam generation, manufacturing, and other business activities, and, in the process impinge and entrain organisms without accounting for the consequences of these actions on the ecosystem or other parties who do not directly participate in the business transactions. The actions of these section 316(b) facilities impose harm or costs on the environment and on other parties (sometimes referred to as *third parties*). These costs, however, are not recognized by the responsible entities in the conventional market-based accounting framework. Because the responsible entities do not account for these costs to the ecosystem and society, they are *external* to the market framework and the consequent production and pricing decisions of the responsible entities. In addition, because no party is reimbursed for the adverse consequences of I&E, the externality is *uncompensated*.

Business decisions will yield a less than optimal allocation of economic resources to production activities, and, as a result, a less than optimal mix and quantity of goods and services, when external costs are not accounted for in the production and pricing decisions of the section 316(b) industries. In particular, the quantity of AEI caused by the business activities of the responsible business entities will exceed optimal levels and society will not maximize total possible welfare. Adverse distributional effects may be an additional consequence of the uncompensated environmental externalities. If the distribution of I&E and ensuing AEI is not random among the U.S. population but instead is concentrated among certain population

[3] Unit 1, which accounted for about 20% of total losses, was taken out of operation in November 1992.

subgroups based on socio-economic or other demographic characteristics, then the uncompensated environmental externalities may produce undesirable transfers of economic welfare among subgroups of the population.

A2-2.4 Reducing Differences Between the States

NPDES permitting authorities have implemented the requirements of section 316(b) in widely varying ways. The language used in the statutes or regulations vary from State to State almost as much as the interpretation. Most States do not address section 316(b) at all.

Table A2-6 on the following page illustrates a variety of ways in which States identify the section 316(b) requirements.

Table.A2-6: Selected NPDES State Statutory/Regulatory Provisions Addressing Impacts from Cooling Water Intake Structures

NPDES State	Citation	Summary of Requirements
Connecticut	RCSA § 22a, 430-4	Provides for coordination with other Federal/State agencies with jurisdiction over fish, wildlife, or public health, which may recommend conditions necessary to avoid substantial impairment of fish, shellfish, or wildlife resources
New Jersey	NJAC § 7:14A-11.6	Criteria applicable to intake structure shall be as set forth in 40 *CFR* Part 125, when EPA adopts these criteria
New York	6 NYCRR § 704.5	The location, design, construction, and capacity of intake structures in connection with point source thermal discharges shall reflect BTA for minimizing environmental impact
Maryland	MRC § 26.08.03	Detailed regulatory provisions addressing BTA determinations
Illinois	35 Ill. Admin. Code 306.201 (1998)	Requirement that new intake structures on waters designated for general use shall be so designed as to minimize harm to fish and other aquatic organisms
Iowa	567 IAC 62.4(455B)	Incorporates 40 CFR part 401, with cooling water intake structure provisions designated “reserved”
California	Cal. Wat. Code § 13142.5(b)	Requirements that new or expanded coastal power plants or other industrial installations using seawater for cooling shall use best available site, design technology, and mitigation measures feasible to minimize intake and mortality of marine life

Source: SAIC, 1994.

Additionally, in discussions with State and EPA regional contacts, EPA has found that States differ in the manner in which they implement their section 316(b) authority. Some States and regions review section 316(b) requirements each time an NPDES permit is reissued. These permitting authorities may reevaluate the potential for impacts and/or the environment that influences the potential for impacts at the facility. Other permitting authorities made initial determinations for facilities in the 1970s but have not revisited the determinations since.

Based on the above findings, EPA believes that approaches to implementing section 316(b) vary greatly. It is evident that some authorities have regulations and other program mechanisms in place to ensure continued implementation of section 316(b) and evaluation of potential impacts from CWIS, while others do not. Furthermore, there appears to be no mechanism to ensure consistency across all States. Section 316(b) determinations are currently made on a case-by-case basis, based on permit writers' best professional judgment. Through discussions with some State permitting officials (e.g., in California, Georgia, and New Jersey), EPA was asked to establish national standards in order to help ease the case-by-case burden on permit writers and to promote national uniformity with respect to implementation of section 316(b).

A2-2.5 Reducing Transaction Costs

Transaction costs associated with the implementation of a regulation include: (1) determining the desired level of environmental quality and (2) determining how to achieve it.

Transaction costs associated with determining the desired level of environmental quality have to do with the supply and demand for environmental quality.

The presence of uncertainties increases transaction costs. Some uncertainties relate to the supply of environmental quality (e.g., the actual impact of various control technologies in terms of the effectiveness of I&E reductions); others relate to the demand for environmental quality (e.g., the value of reduced I&E in terms of individual and population impacts). Reducing uncertainties would reduce transaction costs. Standardizing the protocol for monitoring and reporting I&E impacts reduces the uncertainty about how to measure the impact of controls, and provides for a uniform "language" for communicating these impacts. A Federal regulation that establishes methods for mitigating the impact of regulatory uncertainty and information uncertainty produces a benefit in the form of reduced (transaction) costs.

There is another set of uncertainties that is independent of the desired level of environmental quality. These uncertainties fall into the broad categories of "regulatory uncertainty" and "information uncertainty." The costs related to these uncertainties lead to "transaction costs," which cause inefficiencies in decision-making related to achieving a given level of environmental quality. *Regulatory uncertainty* refers to the uncertainty that facilities face when making business decisions in response to regulatory requirements when those requirements are uncertain. For example, facilities are making business decisions today based on their best guess about what future regulation will look like. The cost of this uncertainty comes in the form of delayed business decisions and poor business decisions based on incorrect guesses about the future regulation. *Information uncertainty* refers to the uncertainty related to the measurement and communication of the impact of controls on actual I&E, as well as the impact of I&E on populations. The consequence of information uncertainty is poor decision-making by stakeholders (suppliers and demanders of environmental quality) and a reduction in the cost-effectiveness of meeting a desired level of environmental quality.

Transaction costs are incurred at several levels, including the States and Tribes authorized to implement the NPDES program, the Federal government, and facilities subject to section 316(b) regulation.

Section 316(b) requirements are implemented through NPDES permits. Each State's, Tribe's, or region's burden associated with permitting activities depends on their personnel's background, resources, and the number of regulated facilities under their authority. Developing a permit requires technical and clerical staff to gather, prepare, and review various documents and supporting materials, verify data sources, plan responses, determine specific permit requirements, write the actual permit, and confer with facilities and the interested public.

Where States and Tribal governments do not have NPDES permitting authority, EPA implements section through its regional offices.

Uncertainty about what constitutes AEI, and the BTA that would minimize AEI, also increases transaction costs to facilities. Without well-defined section 316(b) requirements, facilities have an incentive to delay or altogether avoid implementing I&E technologies by trying to show that their CWIS do not have impacts at certain levels of biological organization, e.g., population or community levels. Some facilities thus spend large amounts of time and money on studies and analyses without ever implementing technologies that would reduce I&E. Better definition of section 316(b) requirements could lead to a better use of these resources by investing them in I&E reduction rather than studies and analyses.

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